

**AMENDMENT UNDER 37 C.F.R. § 1.111**  
**U.S. Appln. No. 09/319,384**

**REMARKS**

Claims 1-19 are all the claims pending in the application. Claims 7, 8, 18, and 19 have been amended to prevent the claims from improperly depending from another multiple dependent claim.

Entry of the above amendments is respectfully requested.

Initially, Applicants thank the Examiner for acknowledging Applicants' claim to priority under 35 U.S.C. §119, and for confirming receipt of the priority document from the International Bureau.

The Examiner has returned with the Office Action dated March 23, 2001 (the Restriction Requirement), the Form PTO-1449 filed with Applicants' IDS on July 21, 1999 and March 2, 2000. However, the Examiner has not initialed or signed the PTO-1449 Forms. In addition, the Examiner has not returned a copy of the initialed and signed PTO-1449 Form, which was submitted on September 15, 1999.

Therefore, Applicants respectfully request that a copy of initialed and signed PTO-1449 Forms be returned with the next communication to Applicants.

**I. Claim Objections**

On page 2 of the Office Action, the Examiner objects to claims 7, 8, 18 and 19 as being in improper form because a multiple dependent claim cannot depend from another multiple dependent claim.

Applicants have amended claims 7, 8, 18 and 19 to prevent the claims from improperly depending from another multiple dependent claim. Accordingly, Applicants respectfully request that the objection be withdrawn.

**II. Response to rejection of claims 1-19 under 35 U.S.C. 112, second paragraph**

On pages 2-3 of the Office Action, the Examiner rejects claims 1-19 as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention. Basically, the Examiner asserts the following.

**A.** The recitation “treating the inside of a porous article” is confusing, and therefore indefinite.

In response, Applicants submit that even a seemingly dense object such as wood is, in many cases, a porous article that is composed with small voids or cavities in microscopic scale. The present invention relates to a liquid composition for treating the pores of such porous articles as wood. Accordingly, in the present invention, macromolecularization is performed using an enzyme having a polyphenol oxidizing activity. The pores of the porous article are treated (i.e., macromolecularization occurs inside the pores).

In addition, “treating” basically means what the dictionary definition is, i.e., to act upon with some agent, especially to improve or alter.

Accordingly, a person of skill in the art would understand the phrase “treating the inside of a porous article”, and therefore Applicants respectfully submit that the scope of the claims are clear.

**B.** The recitation in claim 5, “removing a portion of a water insoluble solid component” is indefinite because the claim does not state what the component is being removed from.

Applicants submit that a portion of a water insoluble solid component is removed from a product of pulp waste liquors. See page 33, lines 17-27 of the present

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specification. In addition, in the Examples, Applicants use lignosulfonate commercially available, so that the present invention can be easily carried out. However, the commercially available lignosulfonate, which is produced as a crude product obtained from the purifying process of pulp waste liquors, contains water-insoluble solid components such as small pieces of pulp and calcium salts, which is known to those skilled in the art. In order to increase the permeation amount of the treating liquid composition, it is desirable that such water-insoluble solid components from pulp waste liquors be removed from the lignosulfonate. The applicable method for removing these components and the size of the components to be removed are as specifically described in DETAILED DESCRIPTION OF THE INVENTION in the specification, and the purpose, reasons, manners and processes for removing, are disclosed in the present specification to enable a person of skill in the art to carry out the present invention, and to understand the scope of the present invention.

Therefore, Applicants submit that the claim 5 is definite.

**C.** The recitation in claims 12 and 13, “equivalent”, is indefinite because it is not clear whether the recitation means that the compound is the same or similar to that, and what the similarity or “equivalence” must be.

In response, Applicants submit that as set forth in the claims, the similarity is with respect to structure (i.e., the claim recites “a synthetic compound having a chemical agent structure equivalent to that of the extracted component from the plant”). In addition, at page 47, line 26 to page 48, line 10, the present specification discloses specific examples of extracted components from plant or synthetic substances having equivalent chemical agent structures to the extracted components from plant.

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Therefore, a person of skill in the art would understand the phrase “equivalent”, and Applicants submit that the scope of the claims are clear.

**D.** The recitation “high concentration” in claim 19 is indefinite because it is not clear how high the concentration must be.

In response, Applicants submit that “high concentration” means that dilution is required, i.e., highly concentrated. The phrase means that several-fold to dozens-fold, specifically, about 2-fold to 100-fold, of dilution is required. For example, Example 21 shows the use of a treating liquid after diluting it 10-fold with water. The dilution rate is decided according to concentrations of the phenolic compound and/or an aromatic amine compound in the liquid used, and further the rate can be determined according to the purpose of the use.

Accordingly, Applicants submit that a person of ordinary skill in the art would understand the meaning of “high concentration” and that the scope of claim 19 is clear.

**E.** Applicants have addressed the rejection of claims 7, 8, 18 and 19 above.

In view of the above, Applicants respectfully request that the rejections be withdrawn.

**III. Response to rejection of claims 1-3, 5-15 and 17-19 under 35 U.S.C. 102(b)**

On pages 4-5 of the Office Action, the Examiner rejects claims 1-3, 5-15 and 17-19 under 35 U.S.C. § 102(b) as allegedly being anticipated by Schneider et al (WO 95/01426).

Applicants respectfully traverse this rejection for the following reasons.

Schneider essentially discloses a method of enzymatic polymerization in solutions, and on surfaces of solid materials or adhered surfaces of solid materials and

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its use. In contrast, the present invention relates to a composition for treating the inner parts of a porous material by allowing reaction in the pores and obtaining an article integrated with the composition.

The Examiner cites Schneider as disclosing a composition comprising an enzyme that may be a laccase, catechol oxidase, bilirubin oxidase from *Myrothecium*, or monophenol monooxygenase. *See* p. 19, lines 1-27. However, Schneider does not disclose a composition containing both an enzyme and a substrate therefor.

In addition, although the Examiner asserts that "Schneider's compositions also comprise lignin at page 6, line 35 to page 7, line 4 of the Office Action, the method disclosed by Schneider is a method comprising treatment of the lignin or lignin containing material with a laccase or a laccase related enzyme in the presence of a source of oxygen and in the presence of an enhancing agent of the invention. *See* page 7, lines 3-4 and page 18, lines 34-35.

Therefore, Schneider does not teach or suggest that lignin is a component of the treating agent, but discloses that lignin is an object of the treatment.

Further, the enzyme used in the present invention requires oxygen in its reaction, and in an environment like inner parts of porous materials where sufficient oxygen is not present, an enzymatic reaction cannot proceed to bring about sufficient macromolecularization. However, the present inventors have found that, in spite of such a small supply of oxygen, if the treating composition is dried after being impregnated into the porous material and the substrates for enzymatic reaction in the composition is condensed enough to accelerate the enzymatic reaction, macromolecularization can proceed efficiently.

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Furthermore, the present inventors discovered that it is much more effective for acceleration of the reaction to control the pH region of the treating liquid to the alkaline side and use an enzyme having the optimum reaction pH in the alkaline side than using a special additive as disclosed in Schneider. With respect to pH, Schneider only refers to it as the reaction pH in activity measurements, and does not teach or suggest accelerating macromolecularization of the phenolic compound in the alkaline pH region. Moreover, in Schneider, the Examples show reactions carried out in acidic pH region of 5.5 and 7.0, and in the neutral pH region.

In contrast, the present invention has been accomplished based on the findings that macromolecularization, which was conventionally performed in the acidic or neutral pH region using laccase, can proceed at an extremely high reaction rate in the alkaline pH region, and that properties of the treating liquid and phenolic compound contained in the liquid can be changed quickly after the reaction initiates by allowing the enzymatic radical polymerization and the non-enzymatic, automatic oxidation to proceed concurrently.

As another feature, the present invention enables production of practically useful treated articles by impregnating an enzyme, its substrate and also other components selected from functional agents into the porous material and fixing them to be integrated with the material to form a matrix so that the added agent exhibits its effect evenly and stably throughout the treated article. Such an idea for production of novel articles is not taught or suggested by Schneider. In particular, Schneider discloses the production of wooden materials using enzymatic polymerization as an adhesive. Although Schneider discloses wood as a porous material, there is not

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teaching or suggest regarding treating and changing the material from the inner part of the material.

The present inventors found that desirable effects for treating porous materials can be obtained by using an enzyme that can oxidatively polymerize phenolic compounds or aromatic amine compounds and selecting a substrate of the enzyme which has suitable radical -polymerizability and a suitable molecular weight, thus achieving the present invention.

In addition, effects of treating porous materials are increased by other components selected from functional agents fixed in tree material together with the treating composition of the present invention. However, even without such an agent, the composition of the present invention can exhibit sufficient effects by itself. For example, in a case where the treating composition is applied to a wood material, first, in the impregnation operation, enzyme substrates having a higher molecular weight are retained and impregnated at a higher concentration on the surface and into the inner parts near the surface of the material by filtration. In deeper parts inside the material, the molecular weight distribution of enzyme substrates inclines to the lower molecular weight side, and as a result, inclination of molecular weights toward inner parts is caused immediately after the impregnation operation. This anisotropy is extremely important to effectively treat wood materials. First, while the wood material impregnated with the treating liquid is drying, on the surface of the material where oxygen is supplied at a higher rate, the enzyme substrates existing at a higher concentration are rapidly macromolecularized into the water-insoluble state, with the result that a composition like a coating film integrated with the material is formed. Next, while the drying proceeds from the surface to the inside, the moisture moves

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from the inside to the surface. Along with this movement, some of the enzyme substrates move from the inside to the surface to join the coating-film-like composition.

During these processes in the material, the enzyme substrates impregnated in the inner parts of the material, which have lower molecular weights, are gradually macromolecularized to be in a final water-insoluble state, as the substrates on the surface are. Such an anisotropic wood material obtained by the above treating mechanism shows a water-resistant effect, which prevents the treating composition impregnated in the material from being leached out by rain or the like, even in a short time after the treatment. In addition, the smooth surface of the coating-film-like composition plays a role to prevent the mycellia of wood decaying fungi from invading into the wood. Further, since phenolic compounds, aromatic amine compounds and polymers thereof are not easily decomposed and have bio-repellency, the composition of the present invention also shows resistance against termites and wood decaying fungi. Accordingly, the composition enzymatically treating inner parts of porous materials of the present invention was, through many difficulties, accomplished with great efforts to provide useful effects by a dexterous mechanism.

In view of the above, Applicants respectfully submit that Schneider fails to teach or suggest the present invention and respectfully request that the rejection be withdrawn.

**IV. Response to rejection of claims 1-6, 8, 15 and 19 under 35 U.S.C. § 102(b)**

On page 5 of the Office Action, the Examiner rejects claims 1-6, 8, 15 and 19 under 35 U.S.C. § 102(b) as allegedly being anticipated by Haars et al. (U.S. Patent 4,432,291). In addition, on page 5 of the Office Action, the Examiner rejects claims 1-



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3, 5, 6, 8, 15 and 19 as allegedly being anticipated by Yde (WO 93/23477).

Basically, the Examiner cites Haars et al. as disclosing compositions comprising lignin or lignin sulfonate and laccase or catechol oxidase or peroxidase in an aqueous solution.

The Examiner cites Yde as disclosing a preparation of a binder for wood by combining a lignin gel with laccase or peroxidase in an aqueous solution. The Examiner asserts that water can be considered a deodorant, a flame retardant, a sanitizer, or an insect repellent.

Applicants respectfully traverse the above rejections for the following reasons.

Applicants submit that Haars and Yde relate to treatment for surfaces of wood, but do not teach or suggest treating the inner parts of porous materials, such as wood. Accordingly, Haars and Yde fail to teach or suggest the present invention.

In addition, Haars is directed to a polymerization reaction of lignin or lignosulfonate as an adhesive, which is different from the present invention

Yde teaches enzymatically polymerizing lignin aqueous solution in the alkaline pH region to obtain highly viscid lignin used for an adhesive. The reaction performed in the alkaline pH region of Yde is substantially different from the present invention because the pH value is raised before reduced to pH 7 or lower. In contrast, in the present invention, since lignin compounds are stably fixed in the treated porous material, the pH in the entire material naturally makes the transit from neutral to weak acid with the lignin compound fixed when the treated material is placed in an environment where it may be in contact with an acidic water like rain.

Also, although adhesiveness is not an object of the present invention, the matrix formed inside the material is further consolidated by the neutralization of pH. Thus,

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the composition of the present invention imparts useful properties to porous materials without additional procedures such as a burdensome pH changing operation.

Accordingly, Applicants respectfully request that the rejection be withdrawn.

**V. Response to rejection of claims 1, 2, 6, 8, 15 and 19 under 35 U.S.C. 102(b)**

On page 6 of the Office Action, the Examiner rejects claims 1, 2, 6, 8, 15 and 19 under 35 U.S.C. § 102(b) as allegedly being anticipated by Isao Kaneko et al. (JPA 7-126377). In addition, on page 6 of the Office Action, the Examiner rejects claims 1, 2, 6, 15 and 19 under 35 U.S.C. § 102(b) as allegedly being anticipated by Naoichi Sakota et al (JPA 6-287516). Further, on page 6 of the Office Action, the Examiner rejects claims 1, 2, 6, 8, 15 and 19 under 35 U.S.C. § 102(b) as allegedly being anticipated by Tetsuo Miyakoshi et al (JP 5-117591).

The Examiner cites Kaneko et al. as disclosing the preparation of a copolymer by combining phenol, aniline and an enzyme that may be a peroxidase in aqueous solution.

In addition, the Examiner cites Sakota et al. as disclosing the preparation of lacquer by combining glycoprotein, polysaccharide, laccase and a urushiol analogue containing at least 60% catechol derivative having both 15-22C alkenyl groups with at least two double bonds in a cis arrangement through a methylene group and at least two hydroxyl groups.

Further, the Examiner cites Miyakoshi et al. as disclosing the preparation of a coating composition useful an adhesive, rustproof, or waterproof, by combining a catechol derivative, vegetable substance, an enzyme which may laccase, ascorbic acid oxidase or tyrosinase, and water.

Applicants respectfully traverse this rejection for the following reasons.

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Applicants submit that Kaneko, Sakota and Miyakoshi relate to treatment for surfaces of wood, but do not teach or suggest treating the inner parts of porous materials, such as wood. Accordingly, Kaneko, Sakota and Miyakoshi fail to teach or suggest the present invention.

In addition, Kaneko relates to utilization of polymerization reaction in aqueous solution, which is different from the present invention.

Sakota relates to artificial production of urushi (Japanese lacquer), conventionally used for coating and adhesion, which is different from the present invention.

Miyakoshi also relates to artificial production of urushi (Japanese lacquer), which is different from the present invention.

In view of the above, Applicants respectfully submit that Kaneko, Sakota and Miyakoshi fail to teach or suggest the present invention. Therefore, Applicants respectfully request that the rejections be withdrawn.

**VI. Response to rejection of claims 1-19 under 35 U.S.C. § 103(a)**

On page 8 of the Office Action, the Examiner rejects claims 1-19 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Haars et al., Yde and Isao Kaneko et al.

The Examiner acknowledges that Haars et al. Yde et al. and Kaneko et al. do not disclose the *in situ* enzymatic preparation of hydrogen peroxide of claim 16. However, the Examiner asserts that a person of ordinary skill in the art would recognize that the hydrogen peroxide required by peroxidases could have been readily generated enzymatically *in situ*.

Applicants respectfully traverse this rejection for the reason that claim 16 is

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allowed at least by virtue of its dependence from claim 1, which is not taught or suggested by the cited prior art as discussed above.

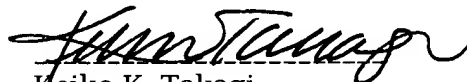
Therefore, Applicants respectfully request that the rejection be withdrawn.

**VII. Conclusion**

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

Applicant hereby petitions for any extension of time which may be required to maintain the pendency of this case, and any required fee, except for the Issue Fee, for such extension is to be charged to Deposit Account No. 19-4880.

Respectfully submitted,



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**APPENDIX**  
**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

**IN THE CLAIMS:**

**The claims are amended as follows:**

7. (amended) The composition for treating the inside of a porous article as claimed in [any one of claims] claim 2 [to 6], wherein the composition contains an unsaturated fatty acid, an unsaturated alcohol or an unsaturated alkyl compound.

8. (amended) The composition for treating the inside of a porous article as claimed in [any one of claims] claim 1 [to 7], wherein the composition contains at least one chemical agent selected from a fragrant, a deodorant, a rust preventive, a flame retardant, an antibacterial agent, an antiseptic, a sanitizer, an insect-repellent, an antiviral agent, and an organism-repellent.

18. (amended) The composition for treating the inside of a porous article as claimed in [any of claims] claim 1 [and 15 to 17], wherein the enzyme having a polyphenol oxidizing activity is an enzyme which has an optimum reaction pH on an alkaline side not lower than pH 7.5 when measured of activity using syringaldazine.

19. (amended) The composition for treating the inside of a porous article as claimed in [any one of claims] claim 1 [to 18], wherein the composition is in the form of a high concentration solution to be diluted upon use, or powder or granulated powder to be dissolved upon use.